pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Nutrient Trading Supplement to Phase 2 Watershed Implementation Plan

October 15, 2014

Section 9 of the Pennsylvania Chesapeake Watershed Implementation Plan, Phase 2 (Phase 2 WIP) describes the use of Pennsylvania's Nutrient Trading Program to implement the Phase 2 WIP. This supplement to Section 9 (Nutrient Trading Supplement) provides an update on policy and program enhancements to the Nutrient Trading Program.

I. Background

Since 2005, the Pennsylvania Department of Environmental Protection ("DEP") has been leading the way nationally in developing its nutrient trading program. The program is one of the first programs in the country to have both agricultural operations (nonpoint sources) and wastewater treatment facilities (point sources) participating in a nutrient credit trading program. Pennsylvania built its program with significant input from stakeholders – and those very stakeholders are now participants in the program. Pennsylvania built its program to meet Pennsylvania's needs with regard to the Chesapeake Bay. The key to the program's success is that it is voluntary and follows the following principles:

- A trade must involve comparable credits (for example, nitrogen may only be traded for nitrogen) that are expressed as mass per unit time (pounds per year);
- Credits generated by trading cannot be used to comply with existing technology-based effluent limits except as expressly authorized by regulation;
- Trading may only occur in a PA DEP defined watershed;
- Trading may take place between any combination of eligible point sources, non-point sources and third party aggregators; and,
- Each trading entity must meet applicable eligibility criteria established under the Nutrient Trading Program regulations, 25 Pa. Code Section 96.8.

The Phase 2 WIP identified the success of the existing program and a plan of action to move forward to address a number of recommendations the U.S. Environmental Protection Agency ("EPA") made in 2012. These recommendations were divided into two tiers, with the first tier being those recommendations specific to Pennsylvania. As stated in the Phase 2 WIP, DEP has been working with stakeholders and EPA to define the details for the plan of action to address these recommendations since 2012.

In April 2014, the U. S. Environmental Protection Agency (EPA) began objecting to the issuance of NPDES permits prepared by DEP that contained Cap Loads and permit language that enabled the use of credits to achieve compliance with those Cap Loads. The objections were based on EPA's concerns with the nonpoint source agricultural baseline requirements in the nutrient trading regulations. EPA asserted that DEP had not made a quantitative demonstration that these requirements achieve the load allocations for agricultural sources in the Chesapeake Bay Total Maximum Daily Load (TMDL). Unlike point source discharges with NPDES permits, agricultural operations cannot quantitatively measure the potential nonpoint source loading of nutrients from their fields. To resolve

EPA's objections and retain the ability to issue the NPDES permits in question, DEP has established additional eligibility and credit calculation requirements to ensure the effectiveness of the use of credits to meet legal requirements of the Chesapeake Bay TMDL as authorized by its regulations (25 Pa. Code §§ 96.8(d)(5) & (e)(3)(vi)) to resolve EPA's objections to the NPDES permits.

This supplement describes those additional requirements. This plan of action is divided into the four key components of the program: Eligibility, Certification, Verification and Registration.

II. Definitions

DEP has previously provided definitions in its supplement to Section 7 of the Phase 2 WIP (Wastewater Supplement) to allow credit trading in its NPDES permits. Those definitions have been updated in the latest Wastewater Supplement and are repeated in this Nutrient Trading Supplement to provide consistency. .

Annual Net Mass Load (lbs): The sum of Monthly Total Mass Loads for one year beginning October 1st and ending September 30th, adjusted for credits sold and applied and offsets applied. Annual Net Mass Loads are compared to Cap Loads to determine compliance.

Baseline: The compliance activities and performance standards that must be implemented to meet current environmental laws and regulations related to the pollutant for which credits or offsets are generated. The term includes allocations established under 25 Pa. Code Chapter 96 (relating to Water Quality Standards Implementation), in a TMDL or in a similar allocation, for the pollutant.

Cap Load (lbs): The mass load of a pollutant authorized by a National Pollutant Discharge Elimination System (NPDES) permit. Cap Loads for Total Nitrogen (TN) and Total Phosphorus (TP) are implemented in NPDES permits by the establishment of Annual Net Mass Load limits. The term "Net" is used to recognize that Credits and Offsets may be used to comply with the limits. The Annual Net Mass Load must be less than or equal to the Cap Load to achieve compliance.

Certification: Written approval by DEP of a proposed pollutant reduction activity to generate credits before the credits are verified and registered to be used to comply with NPDES permit effluent limitations.

Compliance Year: The year-long period starting October 1st and ending September 30th. The Compliance Year will be named for the year in which it ends. For example, the period of October 1, 2012 through September 30, 2013 is compliance year 2013.

Credit: The tradable unit of compliance that corresponds with a unit of reduction of a pollutant as recognized by DEP which, when certified, verified and registered, may be used to comply with NPDES permit effluent limitations.

Delivery Ratio: A ratio that compensates for the natural attenuation of a pollutant as it travels in water before it reaches a defined compliance point.

Offset: The pollutant load reduction measured in pounds (lbs) that is created by an action, activity or technology which when approved by DEP may be used to comply with NPDES permit effluent limitations, conditions and stipulations under 25 Pa. Code Chapter 92a (relating to NPDES permitting, monitoring and compliance.) The offset may only be used by the NPDES permittee that DEP determines is associated with the load reduction achieved by the action, activity or technology.

Registration: An accounting mechanism used by DEP to track certified and verified credits before they may be used to comply with NPDES permit effluent limitations.

Threshold: Activities and performance standards beyond baseline compliance which are required under 25 Pa. Code Chapter 96.8(d)(3) (relating to threshold requirement to generate credits) before credits may be certified.

Total Mass Load (lbs):

Monthly Total Mass Load = The sum of the actual daily discharge loads for TN and TP (lbs/day) divided by the number of samples per month, multiplied by the number of days in the month. The daily discharge load for TN and TP (lbs/day) equals the average daily flow (MGD) on the day of sampling, multiplied by that day's sample concentration for TN and TP (mg/l), multiplied by 8.345.

Annual Total Mass Load = The sum of the Monthly Total Mass Loads for one year beginning October 1st and ending September 30th.

Total Nitrogen (TN): For concentration and load, Total Nitrogen is the sum of Total Kjeldahl-N (TKN) plus Nitrite-Nitrate as N (NO_2+NO_3-N), where TKN and NO_2+NO_3-N are measured in the same sample.

Truing Period: The time provided following each Compliance Year for a permittee to comply with Cap Loads through the application of Credits and Offsets. The Truing Period will start on October 1st and end on November 28th of the same calendar year, unless DEP extends this period. During this period, compliance for the specified year may be achieved by using registered Credits that were generated during that Compliance Year. For example, Credits that are used to achieve compliance in Compliance Year 2012 must have been generated during Compliance Year 2012. Approved Offsets that have been generated may also be applied during the Truing Period.

Verification: Assurance that the verification plan contained in a certification, permit or other approval issued by DEP has been implemented. Verification is required prior to registration of the credits for use in an NPDES permit to comply with NPDES permit effluent limitations.

III. Eligibility/ Requirements for Certification

Before a point source or nonpoint source can generate and trade credits it must meet baseline and threshold requirements as defined in 25 Pa. Code § 96.8. In addition, to address concerns expressed by EPA, the additional eligibility requirements summarized below must be satisfied to generate credits to meet the legal requirements of the Chesapeake Bay TMDL.

A. Point Sources

Effective *October 1, 2015*, for the purpose of generating credits for sale, all point sources with an assigned Cap Load (see Table 7-1 of the Wastewater Supplement to the Phase 2 WIP) are considered certified to generate credits, provided the facility demonstrates treated effluent concentrations below 6.0 mg/L TN and 0.8 mg/L TP (i.e., "baseline concentrations"), and are in accord with the procedures described below under Section IV. (Verification). Additional guidance on how to apply for verification of Credits from a point source can also be found on the nutrient trading website, www.depweb.state.pa.us/nutrient_trading. In addition:

- To generate Credits, facilities must be able to demonstrate they are in compliance with their NPDES permit.
- The total amount of Credits the facility is certified to generate will be equal to their permitted Cap Load.
- This certification will expire on September 30, 2017.
- All existing approved certifications that were approved prior to October 1, 2014 will expire on September 30, 2015. This includes all certifications allowing for the generation of credits using the assigned Cap Load as baseline. This method of credit calculation will not be used after Compliance Year 2015. The formulas and an example of this methodology are below.
- Beginning October 1, 2015 (Compliance Year 2016), the calculation of Credits will be made using new formulas. The formulas and an example are below.

Point Source Credit Calculations

For the period **October 1, 2014 through September 30, 2015**, if the Annual Total Mass Load at the end of the Compliance Year is less than the Cap Load in the permit, the number of Credits that may be verified is determined by the following equation:

(Cap Load – Offsets incorporated into Cap Load (if applicable)* – Annual Total Mass Load) x Delivery Ratio x 0.9, where 0.9 is the factor used to provide a reserve ratio of 10%.

* *In the event that 1) DEP certified credits prior to March 1, 2012 and 2) DEP issued the credit certification in a manner that included Offsets, DEP will register verified Credits until the expiration date of the credit certification.*

Starting October 1, 2015, the calculation of TN and TP credits will be made by the following formulas after the end of a Compliance Year:

TN Credits: [∑(Average Daily Flow on day of sampling x (6.0 mg/L TN – TN Effluent Concentration in sample) x 8.345) / No. Samples Taken During Year] x 365 days/year x TN Delivery Ratio x 0.9

TP Credits: [∑(Average Daily Flow on day of sampling x (0.8 mg/L TP – TP Effluent Concentration in sample) x 8.345) / No. Samples Taken During Year] x 365 days/year x TP Delivery Ratio x 0.9

The average daily flow on the day of sampling in million gallons per day (MGD) is multiplied by the difference between the actual TN and TP effluent concentrations in the sample collected and 6.0 mg/L and 0.8 mg/L, respectively, and the conversion factor of 8.345. The sum of these values is divided by the number of samples taken during the Compliance Year, and then multiplied by 365 days/year, the TN/TP Delivery Ratio, and 0.9 (to account for a 10% reserve).

Example Credit Calculation Starting October 1, 2015

This example assumes only one sample is collected per month. The actual number of samples will generally be greater. Assume the TN Delivery Ratio is 0.7. Effluent sampling at a sewage treatment facility produces the following data for a Compliance Year:

Sampling Date	Sample Result Effluent TN (mg/L)	Average Daily Flow on Day of Sampling (MGD)
10/1/2015	6.5	2.2
11/1/2015	4.6	2.5
12/1/2015	5.1	2.0
1/1/2016	6.0	1.9
2/1/2016	3.8	2.0
3/1/2016	5.5	2.3
4/1/2016	4.2	2.6
5/1/2016	6.4	2.1
6/1/2016	6.9	2.0
7/1/2016	5.8	1.9
8/1/2016	5.2	1.8
9/1/2016	4.7	1.9

Step 1: Determine Total Load Below Baseline

Subtract each Effluent TN concentration from the nutrient trading baseline TN concentration (6.0 mg/L). (Note that for TP, the same step is performed using the nutrient trading TP baseline concentration of 0.8 mg/L). The difference is then multiplied by the Average Daily Flow on Day of Sampling and the conversion factor of

8.345. If the Effluent TN concentration exceeds 6 mg/L, the values will be negative. Sum the Daily Loads Below Baseline.

Calculations and rounding should be completed in accordance with DEP's guidance, Discharge Monitoring Reports Overview and Summary (3800-BK-DEP3047).

Sampling Date	Effluent TN (mg/L)	Baseline TN (mg/L)	Difference (mg/L)	Average Daily Flow on Day of Sampling (MGD)	Daily Load Below Baseline (lbs/day)
10/1/2015	6.5	6.0	- 0.5	2.2	- 9.2
11/1/2015	4.6	6.0	1.4	2.5	29.2
12/1/2015	5.1	6.0	0.9	2.0	15.0
1/1/2016	6.0	6.0	0	1.9	0
2/1/2016	3.8	6.0	2.2	2.0	36.7
3/1/2016	5.5	6.0	0.5	2.3	9.6
4/1/2016	4.2	6.0	1.8	2.6	39.1
5/1/2016	6.4	6.0	- 0.4	2.1	- 7.0
6/1/2016	6.9	6.0	- 0.9	2.0	- 15.0
7/1/2016	5.8	6.0	0.2	1.9	3.2
8/1/2016	5.2	6.0	0.8	1.8	12.0
9/1/2016	4.7	6.0	1.3	1.9	20.6
				TOTAL:	**134.2**

Step 2: Divide the Total Load Below Baseline by the number of samples collected during the compliance year:

134.2 / 12 = 11.183

Step 3: Multiply by 365 days/year, TN Delivery Ratio and 0.9:

11.183 x 365 x 0.7 x 0.9 = 2,571.53, round to **2,572 TN Credits**

B. Nonpoint Sources (NPS)

1. *Existing Credit Certifications Approved Prior to October 1, 2013*

   Three types of nonpoint source activities have Credit certifications approved prior to October 1, 2013. No adjustments will be made to the Credit calculation methodology for these approved certifications. The majority of these existing certifications expire on September 30, 2015. The few existing certifications approved prior to October 1, 2013 with designated expiration dates after September 30, 2015 will all expire on September 30, 2016. These nonpoint source activities with approved Credit certifications include:

- Agricultural best management practices (BMPs)
- Manure nutrient destruction and conversion technologies
- The export of poultry manure (litter) and agricultural application outside of the Chesapeake Bay watershed. **Note, the export of poultry manure will not be recognized as an eligible pollutant reduction activity for the purpose of generating credits after September 30, 2015.**

Generators of Credits from agricultural operations and manure destruction and conversion technologies will need to re-apply for certification at least six months before the expiration of their current certification. The appropriate adjustments to baseline and threshold described below will be made in order to meet the expectations of the TMDL at that time.

2. *Credit Certification Applications Approved After October 1, 2013, but prior to September 30, 2017, or the date the World Resource Institute (WRI) Multi-State Trading Tool is finalized and calibrated to Phase 6 of the Chesapeake Bay Watershed Model, whichever is earlier.*

   Baseline and Threshold Requirements – Practice Based Approach

   For nonpoint sources, baseline includes compliance with the following regulations, as applicable:

   - 25 Pa. Code Chapter 102, Erosion and Sedimentation Control Regulations – All plowing and tilling activities must implement and maintain BMPs to minimize the potential for accelerated erosion and sedimentation. Written erosion and sedimentation control plans are required for agricultural plowing or tilling or animal heavy use areas that disturb 5,000 square feet or more.
   - 25 Pa. Code Section 91.36 – these regulations define pollution control and prevention requirements at agricultural operations, including requirements related to land application of animal manure.
   - 25 Pa. Code Section 92a.29 – these regulations define the requirements for Concentrated Animal Feeding Operations (CAFOs) with NPDES permits.
   - 25 Pa. Code Chapter 83, Subchapter D – these regulations promulgated by the State Conservation Commission define and regulate Concentrated Animal Operations (CAOs) through the development and implementation of Nutrient Management Plans.

   The additional threshold requirements that must be met before an agricultural operation can generate credits include implementation of one of the following:

   - Manure not mechanically applied within 100 feet of a perennial or intermittent stream with a defined bed or bank, a lake or a pond, and commercial fertilizer is applied at or below appropriate agronomic rates.
   - A minimum of 35 feet of permanent vegetation is established and maintained between the field and any perennial or intermittent stream with a defined bed or

bank, a lake, or a pond. No mechanical application of manure may occur within the 35 foot vegetative buffer.

- A downward adjustment of at least 20% to the overall amount of pollution reduction generated by the pollution reduction activity.

An additional 3:1 trading ratio will be applied to the number of Credits generated once the defined baseline compliance and threshold is reached, as authorized by the regulations (25 Pa. Code § 96.8(e)(3)(vi)). The Credit calculation tool that must be used to calculate the number of Credits to be certified is the practice-based spreadsheet created by DEP and the World Resource Institute for the Nutrient Trading Program in 2007. These Credit certifications approved by DEP will expire September 30, 2017 regardless of when DEP receives the Credit certification application.

The eligibility of manure destruction and conversion technologies will be determined based upon a thorough review of the individual technology and, at a minimum, compliance with all local, state, and federal requirements. If the number of Credits generated will be verified using a comprehensive sampling and monitoring protocol, where actual reductions in nutrients can be measured and verified, no additional adjustment may be necessary. However, if it is determined during the technical review of the verification plan that the sampling and monitoring protocols are not sufficient to ensure consistency with the defined Chesapeake Bay Program (CBP) protocols[1], then an additional ratio of up to 3:1 may be applied to the generated Credits. These approved certifications will expire September 30, 2017 regardless of when DEP receives the credit certification application.

3. *Credit Certification Applications Approved After October 1st, 2017 or when the approved WRI Multi-State Trading Tool is finalized and calibrated to Phase 6 of the Chesapeake Bay Watershed Model, whichever is earlier.*

   <u>Baseline Requirements – Performance Based Approach</u>

   DEP is in the process of refining the WRI Multi-State Trading Tool being developed in partnership with the Chesapeake Bay Foundation and the Chesapeake Bay Program to calculate credits from agricultural nonpoint sources using a performance based approach. When this tool is developed and calibrated to Phase 6 of the Chesapeake Bay Watershed Model, eligibility to generate Credits will be determined by compliance with the following regulations, as applicable:

   - 25 Pa. Code Chapter 102, Erosion and Sedimentation Control Regulations – All plowing and tilling activities must implement and maintain BMPs to minimize the potential for accelerated erosion and sedimentation. Written erosion and sedimentation control plans are required for agricultural plowing or tilling or animal heavy use areas that disturb 5,000 square feet or more.

[1] The Chesapeake Bay Program is forming an Expert Panel to determine pollution control performance measure estimates, specifically N, P, and sediment, for several BMPs that fall under a broad umbrella of practices termed "manure technologies." Approximate completion of these BMP protocols is the end of 2015.

- 25 Pa. Code Section 91.36 – these regulations define pollution control and prevention requirements at agricultural operations, including requirements related to land application of animal manure.
- 25 Pa. Code Section 92a.29 – these regulations define the requirements for Concentrated Animal Feeding Operations (CAFOs) with NPDES permits.
- 25 Pa. Code Chapter 83, Subchapter D – these regulations promulgated by the State Conservation Commission define and regulate Concentrated Animal Operations (CAOs) through the development and implementation of Nutrient Management Plans.

Credits calculated using the performance-based trading tool approved by DEP that exceed the nutrient baseline loading rate[2] (lb-TN or TP/acre) as determined by the Chesapeake Bay Watershed TMDL model run can be certified. These Credit certification applications will be approved for five years.

The eligibility for manure destruction and conversion technologies will be determined based upon a thorough review of the individual technology and, at a minimum, compliance with all local, state, and federal requirements. If the number of Credits generated will be verified using a comprehensive sampling and monitoring protocol, where actual reductions in nutrients can be measured and verified, no additional adjustment may be necessary. However, if it is determined during the technical review of the verification plan that the sampling and monitoring protocols are not sufficient to ensure consistency with defined CBP protocols[1], then an additional adjustment may be made using the performance-based modeling tool, and/or other technology specific CBP approved modeling/calculation tools, to calculate the final number of generated nutrient credits. These certification applications will be approved for five years.

Should this performance-based modeling tool not be available by September 30, 2017, DEP will continue to review requests for Credit certification using the practice-based approach with the 3:1 trading ratio as described above until the performance-based modeling tool becomes available. Credit certification applications previously approved under the practice-based approach that expire on September 30, 2017 may be administratively extended until the performance-based modeling tool becomes available on an annual basis for a total term of not more than five years (25 Pa. Code § 96.8(e)(8)).

IV. Certification Review Process

Certification is a written approval by DEP of a proposed pollutant reduction activity to generate credits before the credits are verified and registered for compliance with a NPDES permitted facility.

[2] The scale of the definition of this loading rate requirement will be defined when the credit calculation tool is finalized and calibrated. The final loading rates that must be met will be posted on the DEP website at www.depweb.state.pa.us/nutrient_trading.

Nonpoint Sources

A general overview of DEP's certification process for nonpoint sources follows:

- All credit certification applications must be submitted using DEP form, Certification of Nutrient Credits Nonpoint Source, Document #3800-FM-BPNPSM0503.
- All credit calculations must be made using the appropriate *Nitrogen or Phosphorus Spreadsheet* found on the DEP Nutrient Trading website at http://www.depweb.state.pa.us/nutrient_trading .
- Within several weeks of receipt of the request for certification, an administrative completeness review will be performed.
- Administratively complete credit certification applications will be published in the PA Bulletin for public comment. The Bulletin Notice will allow 30 days for public comment.
- During the public comment period, DEP will complete the technical review of the credit certification application.
- After 30 days' time period given for public comments AND successful completion of a technical review DEP will approve the request for certification.
- A Verification Plan is also required to be submitted as part of the Certification. This Verification plan is also reviewed and approved by DEP. The currently approved spreadsheets for both point and nonpoint source generators are located on DEP's Nutrient Trading Website at http://www.depweb.state.pa.us/nutrient_trading.

The generators of existing approved nonpoint source credits as of October 1, 2013 will need to re-apply for credit generation six months before expiration of their current certification where the adjustments described above to the credit calculation methodology will be made. Generators should check DEP's Nutrient Trading Website at http://www.depweb.state.pa.us/nutrient_trading for any changes in the application process relative to re-application.

Point Sources

Effective *October 1, 2015*, for the purpose of generating credits for sale, all point sources with an assigned Cap Load (see Table 7-1 of the Wastewater Supplement to the Phase 2 WIP) are considered certified to generate credits, provided the facility demonstrates effluent concentrations below 6.0 mg/L TN and 0.8 mg/L TP. These effluent concentrations are considered "baseline concentrations" for eligibility to generate credits. After October 1, 2015 through September 30, 2017, point sources will not be required to submit requests for certification of credits to DEP. However, requests for the verification and registration of credits for compliance purposes will still be required.

V. Verification Process

Verification is a written approval by DEP that the pollutant reduction activity(s) generated nutrient credits based upon the approved verification plan in the certification application. The following explains the verification process:

- Nonpoint source credit generators must follow their approved verification plan, to generate, and have DEP approval of credits, before they can sell them.

- Point sources must submit their Discharge Monitoring Report (DMR) information using the approved DEP Supplemental DMR spreadsheets, available on DEP's website.
- Verified credits are only usable in the compliance year they were generated.
- Nonpoint source credit generators will use the Nitrogen Spreadsheet and Phosphorus Spreadsheet to calculate nutrient credits in addition to all other conditions set forth in their approved certification.
- Point source credit generators will use the Nutrient Monitoring (3800-FM-BPNPSM044), Nitrogen Budget (3800-FM-BPNPSM0445) and Phosphorus Budget (3800-FM-BPNPSM0446) forms to calculate credits in addition to all other conditions set forth in their approved certification.
- The appropriate Chesapeake Bay Model Delivery ratio is applied to all verified pollution reduction activities. The delivery ratios for sewage treatment facilities are defined in the Phase 2 WIP Wastewater Supplement, Table 7-1. The delivery ratios for nonpoint sources are summarized below by Chesapeake Bay Watershed Model Segment.
- A 10% reserve factor is applied to all verified pollution reduction activities.

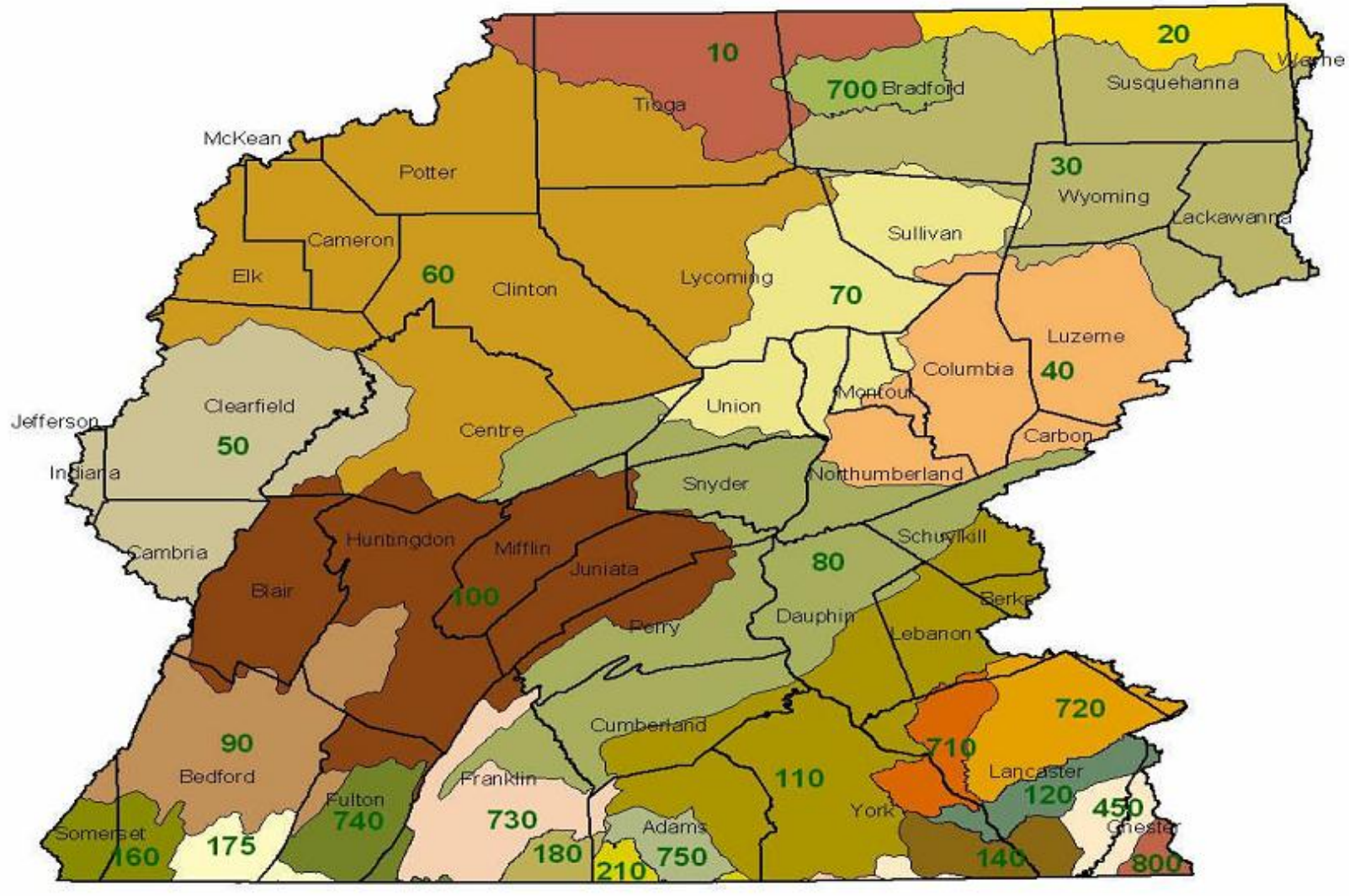
VI. Registration Process

- Registration is the sale of credits and assignment of those credits to an NPDES permit.
- Buyers and Sellers must fill out the Registration Form, 3800-FM-BPNPSM0504, attach a valid contract and send these documents to DEP to start the registration process.
- After review, DEP will issue a Registration letter to the seller and buyer listing the number of credits applied to the NPDES permit and a registry number.

Data on Certification, Verification and Registration is tracked in the DEP Nutrient Trading Database and posted on the DEP website at http://www.depweb.state.pa.us/nutrient_trading .

Watershed Segment Map

This map is coded by colors and each color corresponds to a segment (the number in green). This segment number will then allow you to choose the appropriate nitrogen or phosphorous delivery ratio and appropriate nitrogen or phosphorous edge of segment ratio from the table listed on the second page. For example, if your property is in Bedford, you would be in segment 90 which would give a nitrogen delivery ratio of 0.897 and a nitrogen edge of segment ratio of 15 % to 45% depending on the tillage practice.



Delivery and EOS Ratios

Watershed Segment	Nitrogen Delivery Ratio	Nitrogen EOS Ratio (see Notes 1 & 2)				Watershed Segment	Phosphorus Delivery Ratio	Phosphorus EOS Ratio (see Notes 1 & 2)			
		Conventional Till	Conservation Till	Hay	Pasture			Conventional Till	Conservation Till	Hay	Pasture
10	0.474	36%	29%	89%	15%	10	0.436	10%	4%	4%	15%
20	0.495	38%	31%	34%	16%	20	0.436	13%	7%	5%	16%
30	0.733	43%	31%	78%	16%	30	0.436	11%	6%	7%	16%
40	0.871	42%	38%	60%	12%	40	0.436	12%	10%	7%	12%
50	0.836	50%	38%	97%	18%	50	0.436	15%	6%	14%	18%
60	0.93	55%	31%	78%	15%	60	0.436	11%	4%	16%	15%
70	0.941	45%	45%	86%	13%	70	0.436	27%	7%	12%	13%
80	0.951	32%	25%	75%	10%	80	0.436	12%	7%	7%	10%
90	0.897	45%	34%	49%	15%	90	0.436	11%	4%	12%	15%
100	0.88	35%	29%	32%	12%	100	0.436	8%	3%	5%	12%
110	0.961	31%	22%	27%	10%	110	0.436	9%	5%	5%	10%
120	0.98	29%	21%	20%	9%	120	0.436	8%	3%	4%	9%
140	0.99	30%	22%	22%	9%	140	0.436	25%	10%	7%	9%
160	0.583	33%	28%	59%	23%	160	0.67	32%	27%	7%	23%
175	0.7	33%	22%	29%	20%	175	0.67	5%	5%	6%	20%
180	0.819	34%	38%	58%	9%	180	0.67	9%	7%	4%	9%
210	0.72	46%	33%	40%	10%	210	0.669	11%	7%	7%	10%
450	1	30%	22%	16%	9%	450	1	5%	2%	2%	9%
470	1	25%	17%	23%	6%	470	1	22%	3%	3%	6%
700	0.7	40%	35%	37%	13%	700	0.436	7%	6%	5%	13%
710	0.97	28%	21%	15%	9%	710	0.436	6%	2%	2%	9%
720	0.891	27%	21%	16%	9%	720	0.436	6%	3%	3%	9%
730	0.683	23%	22%	43%	11%	730	0.67	15%	8%	6%	11%
740	0.749	21%	17%	50%	12%	740	0.67	12%	8%	8%	12%
750	0.627	47%	33%	38%	10%	750	0.67	13%	7%	5%	10%
800	1	48%	34%	34%	9%	800	1	15%	8%	11%	9%

Notes:
1. The portion of nutrient loads leaving a watershed were estimated by adding the manure, fertilizer, air deposition and mineral/residual nutrient inputs for each watershed and subtracting the estimated crop uptake from the total nutrient inputs. The remaining nutrient loads after crop uptake were then divided by the estimated loads leaving the watershed to calculate the edge of watershed percents.
2. All calculations based on watershed simulations completed by EPA's Chesapeake Bay Program Office.